

REMARKS

Applicant has carefully reviewed the Office Action mailed February 12, 2009. At the time of the Office Action, Claims 25-46 were pending. Applicant has amended Claims 25-27, 33, 35-37, 42 and 43 and has cancelled Claim 46. Applicant submits the following remarks for consideration.

Applicant's response to Examiner's *Response to Arguments*

Referring to Claim Rejections - 35 U.S.C. §102, the Examiner states, "With respect to the rejection of Claims 25-29, 32-40 and 42-45 as being anticipated by Baldeschwieler in view of Iijima to show a state of fact, Applicants traversal is on the grounds that "Baldeschwieler et al. does not disclose a pore and they do not disclose a carbon nanotube coupled to the pore." (Remarks of 10/15/2008 at 2). The issue as framed here by Applicants is whether the pore can be formed by a coating, as taught by Baldeschwieler. The Examiner respectfully submits that it is immaterial that the pore was formed by a coating or by removing material from the underlying substrate."

The Applicant claims that Baldeschwieler et al. do not disclose a pore as described in the Specification, instead, Baldeschwieler et al. disclose an area. The discussion of the forming process disclosed by Baldeschwieler et al. was to merely demonstrate the physical difference between a pore and an area. The pore described in the Specification is physically different from the area described by Baldeschwieler et al., and it is therefore unreasonable to claim that Baldeschwieler et al. teaches about pores. The Specification discloses volumetric pores that, for example, have depth longer than its diameter, "The advantage of using IM and EB technologies to fabricate a NCRS is that they can produce holes with diameters as small as 10 nm. In addition, the location and dimension of a feature, including a hole, can be achieved with nanometer dimensional tolerances. Additionally, depths of hundreds of nanometers can be achieved with IM and EM." (Specification 11:14) Baldeschwieler et al. do not disclose pores that have depth longer than its diameter. The Applicant has amended Claim 25 as to further define the

description of the pore. The amended Claim 25 includes the limitation that “the pore has depth longer than its diameter.” Illustration of a pore with depth longer than its diameter can be seen in Figures 2 and 3 of the Specification. Detailed description about the depth of the pore and a hole and their fabrication can be found on pages 8-11 of the Specification.

Referring to Claim Rejections - 35 U.S.C. §103, the Examiner states, “With respect to the rejection of Claims 25-45 as being obvious over Baldeschwieler and Iijima in view of Li, et al., Applicants traversal is on the grounds that neither Baldeschwieler, Iijima or Li teaches a pore fabricated at a specific location on the protrusion. (Remarks of 10/15/2008 at 4). The issue with this claim limitation is that reciting “a specific location” doesn't really limit the claim.”

The Specification discloses MEMS devices having carbon nanotubes located at specific locations which makes the devices more useful. This is achieved by fabricating the pore at the specific location where the nanotube has to be. For example, for an AFM tip the preferred location for the pore and the carbon nanotube is at the apex of the tip, “Another way to control the location and number of a NCRS is to use the geometry of the substrate to etch at desired location and do not etch at all or etch at different rates the areas surrounding the desired area. A pointy substrate (such as the AFM tip) the apex will etch a NCRS first, prior to any etching around it. In addition, if the AFM tip apex is sufficiently small only small number of holes will be etched. In extreme cases only one hole will be formed.” (Specification 10:20) Baldeschwieler et al. do not disclose at least one nano-sized pore located near the end of a protrusion distal from the substrate where the pore has depth longer than its diameter. Li, et al. do not disclose a protrusion, nor a nano-sized pore located near the end of a protrusion distal from the substrate.

The Applicant has amended Claim 25 as to further define the specific location of the pore. The amended Claim 25 includes the limitation that “at least one nano-sized pore located near the end of the protrusion distal from the substrate.” Figures 2, 3, and 4 of the Specification illustrate at least one protrusion extending from the substrate and at least one nano-sized pore located near the end of the protrusion distal from the substrate.

Claim Rejections - 35 U.S.C. §102

The Examiner has rejected Claims 25-29, 32-40 and 42-45 under 35 U.S.C. 102(b) as being anticipated by WO 96/38705 to Baldeschwieler, et al. (California Institute of Technology) in view of Iijima, et al., *Single-shell carbon nanotubes of 1-nm diameter of 1-nm diameter*, Nature 1993: 363: 603-605 (hereinafter "Iijima at _").

The Examiner states, "With respect to Claims 25-29, Baldeschwieler discloses a device comprising a substrate, a protrusion, pore and carbon nanotube. *See generally* (Baldeschwieler "Figs 1-6"). Note also the passages at (Baldeschwieler 6: 1-18) (tip and substrate/"cantilever" of the same material, silicon), (Baldeschwieler 14:23 - 15:6), and (Baldeschwieler 30: 1-11) (discussing nanotubes). Figures 5-6 teach the "pore on the protrusion" limitation."

As amended, Claim 25 includes the limitation that "at least one protrusion extending from the substrate, at least one nano-sized pore located near the end of the protrusion distal from the substrate, wherein the pore has depth longer than its diameter." Support for the amended claim was argued and described in detail in the preceding discussion, which is expressly incorporated herein by reference, in the section, Applicant's response to Examiner's *Response to Arguments*. Baldeschwieler et al. do not disclose nor teach pores that have depth longer than its diameter. Li, et al. do not disclose nor teach a protrusion extending from the substrate, and they do not disclose nor teach a nano-sized pore located near the end of a protrusion distal from the substrate. Therefore, the Applicant respectfully requests that Claims 25-29, 32-40 and 42-45 be allowed.

Claim Rejections - 35 U.S.C. §103

The Examiner has rejected Claims 25-29, 32-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 96/38705 to Baldeschwieler, et al. (California Institute of Technology) in view of Iijima, et al., *Single-shell carbon nanotubes of 1-nm diameter of 1-nm diameter*, Nature 1993: 363: 603-605.

The Examiner states, "The preceding discussion of Baldeschwieler accompanying the anticipation rejection *supra* is expressly incorporated herein by reference."

As amended, Claim 25 includes the limitation that "at least one protrusion extending from the substrate, at least one nano-sized pore located near the end of the

protrusion distal from the substrate, wherein the pore has depth longer than its diameter, and at least one carbon nanotube connected to the pore, wherein the nanotube is partially embedded into the pore.” Support for the amended claim, describing that the pore has depth longer than its diameter, is illustrated in Figures 2 and 3 of the Specification, in Specification 11:14, and in general in pages 8-11 of the Specification. Support for the amended claim, describing that at least one nano-sized pore is located near the end of the protrusion distal from the substrate, is illustrated in Figures 2, 3, and 4 of the Specification and in Specification 10:20. Support for the amended claim, describing that at least one carbon nanotube is connected to the pore, where the nanotube is partially embedded into the pore is disclosed in “Timing of the wet etching is also used as a means to control the nanotube's length, namely how far it protrudes from the bottom of the substrate. A crucial step in controlling nanotube length is to time the etching process so as to only expose the desired length of the nanotube and keep part of it buried in the substrate for structural support. For the etchant and the substrate chosen, the etching rate can be empirically determined or is known. Knowing the etching rate, the etching time that results in uncovering the desired length of nanotube is calculated. The desired total length of the carbon nanotube is the length of the template. The length of nanotube that must remain embedded in the substrate determines the depth to which the template must be etched away. The depth to which the nanotube has to be embedded in the substrate to function as an AFM tip with the required strength.” (Specification 18:24) (emphasis added)

Baldeschwieler et al. do not disclose nor teach pores that have depth longer than its diameter, and they do not disclose nor teach a carbon nanotube connected to the pore in such a way that the nanotube is partially embedded into the pore. As shown in Figures 5 and 6 in Baldeschwieler et al. disclose a molecule or a nanotube that is attached with one of its ends to a small area of a tip, “Referring to Figure 6, the completed tip comprises a single, rigid macromolecule 45 rigidly attached to a small area of the apex of a scanning probe tip 42.” (Baldeschwieler 31:23)

Iijima, et al. do not disclose nor teach a protrusion extending from the substrate, and they do not disclose nor teach a nano-sized pore located near the end of a protrusion distal from the substrate, and they do not disclose nor teach pores that have depth longer

then its diameter, and they do not disclose nor teach a carbon nanotube connected to the pore in such a way that the nanotube is partially embedded into the pore.

Baldeschwieler et al. in view of Iijima, et al., independently of each other or in combination with each other, do not disclose a device comprising at least one protrusion extending from the substrate, at least one nano-sized pore located near the end of the protrusion distal from the substrate, wherein the pore has depth longer than its diameter, and at least one carbon nanotube connected to the pore, wherein the nanotube is partially embedded into the pore. Therefore, the Applicant respectfully requests that Claims 25-29, 32-45 be allowed.

The Examiner has rejected Claims 25-46 under 35 U.S.C. 103(a) as being unpatentable over WO 96/38705 to Baldeschwieler, et al. (California Institute of Technology) in view of Iijima, et al., *Single-shell carbon nanotubes of 1-nm diameter of 1-nm diameter*, Nature 1993: 363: 603-605 in view of Li, et al., *Large-Scale Synthesis of Aligned Carbon Nanotubes*, Science 1996; 274: 1701 1703 (hereinafter "Li at _").

The Examiner states, "The preceding discussion of Baldeschwieler accompanying the anticipation rejection *supra* is expressly incorporated herein by reference." and "Li discloses carbon nanotubes grown from a catalyst particle (iron) deposited in pores. See (Li "entire document, Fig. 4"). Note that Li describes the ability to control the geometries of the carbon nanotubes via the in situ CVD technique. See e.g (Li at 1703, col. 1). One would be motivated to utilize the pore/catalyst as taught by Li in the probe of Baldeschwieler for any number of reasons, for example the ability to grow uniform nanotubes. There is nothing on the record to indicate that the present nanotubes differ from those of the prior art (see specification pgs. 14-16)."

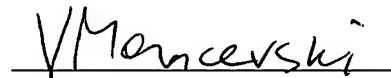
The preceding discussion regarding Baldeschwieler et al. in view of Iijima, et al. is expressly incorporated herein by reference. Furthermore, Li, et al. do not disclose nor teach a protrusion extending from the substrate, and they do not disclose nor teach a nano-sized pore located near the end of a protrusion distal from the substrate. Therefore, Baldeschwieler et al., Iijima, et al., and Li et al. independently of each other or in combination with each other, do not disclose device comprising at least one protrusion

extending from the substrate, at least one nano-sized pore located near the end of the protrusion distal from the substrate, wherein the pore has depth longer than its diameter, and at least one carbon nanotube connected to the pore, wherein the nanotube is partially embedded into the pore.

Furthermore, because Baldeschwieler et al. do not disclose device where the pore has depth longer than its diameter, and at least one carbon nanotube connected to the pore, wherein the nanotube is partially embedded into the pore it would not have been obvious to them to use or combine the disclosure by Li et al. Because Li et al. do not disclose a device having a protrusion extending from the substrate and a nano-sized pore located near the end of a protrusion distal from the substrate, it would not have been obvious to them to use or combine the disclosure by Baldeschwieler et al. Therefore, the Applicant respectfully requests that Claims 25-45 be allowed. The Applicant cancels Claim 46 without prejudice or disclaimer.

In light of the above amendment and remarks, Applicant respectfully submits that the application is in condition for allowance and respectfully requests early allowance. Should the examiner wish to contact the Applicant in order to further prosecution of this matter, the Applicant may be reached at (512) 659-9045.

Respectfully submitted,



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